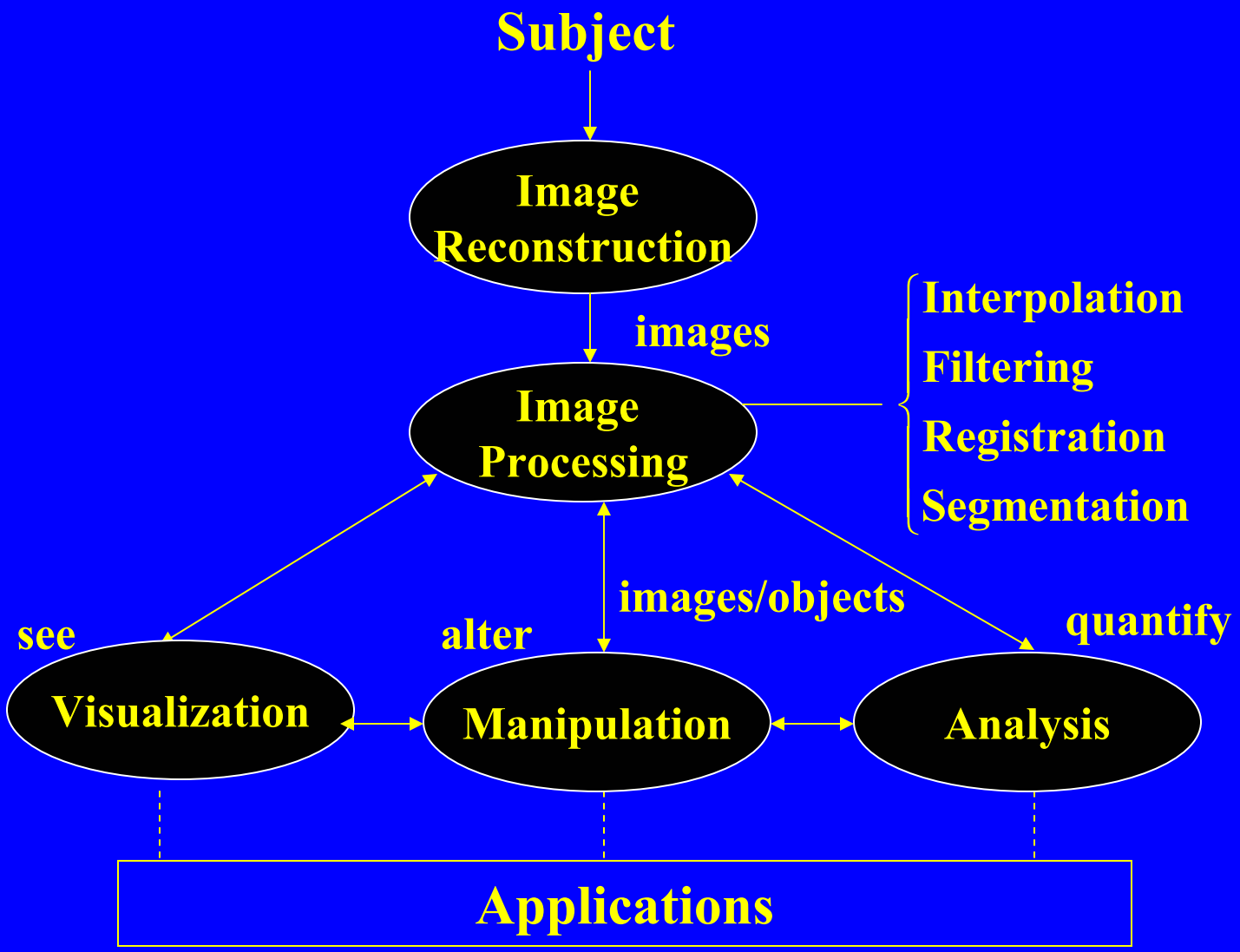
# Data Reconstruction, Interpretation, and Informatics: Research Needs in Image Segmentation, Registration, Visualization

**Jayaram K. Udupa**

Medical Image Processing Group
Department of Radiology
University of Pennsylvania
Philadelphia, PA


Subject
Image Reconstruction
images
Image Processing
Interpolation
Filtering
Registration
Segmentation
images/objects
see
alter
quantify
Visualization
Manipulation
Analysis
Applications

# Image Processing

Interpolation
Filtering
Registration
Segmentation

They all need object info for Effectiveness

$\Rightarrow$ segmentation requires segmentation.

- Segmentation – mother of all problems.
- Deformable registration – difficult problem.

To handle uncertainties realistically, need fuzzy approaches. Need fuzzy topology, geometry, mechanics.

# Visualization

- **Need new ways without losing relevant info.**

  Fundamental advances outside of SR and VR.

  Combined multimodality and/or structure/function visualization.

- **Speed**

  Specialized hardware architectures have come and gone.

  Need general–purpose, portable, programmable speed-up techniques that can evolve with main-stream computing.

# Manipulation/Analysis

- Manipulation : In infancy
  Need fundamental advances to enable interacting with and modifying rigid/ deformable (fuzzy) object systems.

- Analysis : Need fundamental advances in fuzzy morphometry, geometry, mechanics.

# Summary of Needs

## 1. Segmentation

- Need segmentation workshop: frameworks that can be readily adapted to an application.
- Need segmentation evaluation frameworks: complete comprehensive image data, true segmentations, evaluation methodology, and software incorporating standard segmentation methods and evaluation methodology.

## 2. Visualization

- Need new rapid methods of viewing just the relevant information.
- Need general-purpose solutions giving 3-4 orders of magnitude speed-up on rendering techniques.